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# The Growth of Singapore and Hong Kong in the Face of Climate Change and Environmental Degradation

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Singapore and Hong Kong have positioned themselves to play critical roles in the development of the economies of Southeast Asia. Over the last half century, Singapore, a nation that gained independence from Malaysia in 1965, and Hong Kong, a Special Administrative Region of China, have undergone tremendous growth. While both were colonies of the United Kingdom, the two city-states now rank among the world's highest in term of income per capita, educational quality, and economic growth. Singapore is a regional logistics hub, due to its location at the center of Southeast Asia, and its port, which is one of the busiest in the world. Hong Kong also benefits from an active port, and serves as a critical nexus between Mainland China and the United States.

As opposed to the growth of older global cities such as London and New York, which pioneered the industrial revolution, Hong Kong and Singapore have to be aware of the challenges of the 21st Century. Environmental degradation, climate change, rising sea levels, and declining water and air quality, could pose great risks to these cities' sustained growth. Black pillars of smoke emitted from factories were once viewed as a sign of progress for early cities, the same would be frowned upon, and in some communities unacceptable today. Conversely, cities that take the initiative to protect the environment and have branded themselves as green cities have received international recognition and awards, as well as a boon to their economy from the corresponding ecotourism.

In this paper, I will analyze the environmental challenges that Singapore and Hong Kong confront as they continue to grow their economies, and highlight the steps that the cities have

taken to resolve them. I will discuss how they have been able to work with their neighbors to build regional pacts in Singapore's case, or how Hong Kong has had to work with Mainland China to achieve its environmental goals. I will also review how the actions taken by Hong Kong and Singapore are aligned with global environmental efforts, such as the Paris Climate Accords. In a later section of the paper, I will provide an overview of the environmental challenges and policies of London and New York, and contrast them with the environmental programs initiated by Hong Kong and Singapore.

## I. Singapore and Hong Kong's Environmental Challenges and Responses

### A. Singapore

Singapore, the Lion City, is an island nation of 5.7 million people[1]. The large majority of the population, 74.6% is Chinese; Malaysians and Indians, 13% and 9% respectively, make up the the rest of the population. Its total land area is 697 sq. km., which is roughly 3.5 times the size of Washington D.C. Singapore is located south of Malaysia, there is a 1 km causeway connecting the two nations. South of Singapore are the Riau Islands of Indonesia. Singapore lies very near to the equator and as a result enjoys a tropical climate, with temperature averaging 27 degrees Celsius year round. Singapore is a highly developed and advanced nation; its GDP per capita is $87,100, which is the fifth highest in the world[2]. Singapore's economic success has been attributed to Lee Kwan Yew, the country's first prime minister, and the People's Actions Party, his party that has ruled essentially unopposed since the country's founding.

[1] "The World Factbook: SINGAPORE." *Central Intelligence Agency*. Central Intelligence Agency, 12 Jan. 2017. Web. 23 Apr. 2017.
[2] Id.

Singapore's economic success has translated into an extremely high quality of life for its citizens, the 5th highest in the world[3]. Singapore's life expectancy is 85 years. Singapore's infrastructure system is also one of the world's best. Its airport, the Changi Airport, was awarded the Skytrax World's Best Airport Award for the fifth consecutive year in 2017[4]. Every resident of Singapore has access to improved drinking water, improved sanitation facilities, and a world class public transit system. Singapore's Mass Rapid Transit System (SMRT) is integral to life in the country and 6 out of 10 Singaporeans use the system to get to work[5].

Even though Singapore has been very successful economically, it has confronted issues with respect to its environmental record. A report by the National University of Singapore, ranked the nation as the worst environmental offender among 179 countries[6]. The report blamed Singapore's rapid urbanization for its poor environmental record and found that over the last 30 years Singapore has lost 90 per cent of its forest, 67 per cent of its birds, about 40 per cent of its mammals and 5 per cent of its amphibians and reptiles. Singapore has also been cited has having one of the highest per capita carbon dioxide emissions from the consumption of energy[7]. Singapore relies heavily on natural gas for the production of energy, and over the years has reduced its reliance on oil for energy production[8]. Still, Singapore ranks the highest among all

[3] "Human Development Report 2016 – "Human Development for Everyone"" (PDF). HDRO (Human Development Report Office) United Nations Development Programme. Retrieved 22 March 2017
[4] "Changi Airport is named the world's best airport for the fifth consecutive year by international air travellers." Changi Airport. Web. 22 Apr. 2017.
[5] Lee, Pearl. "More Singaporeans Take Bus, MRT to Work: Government Survey." The Straits Times. 11 Oct. 2016. Web. 21 Apr. 2017.
[6] Vaughan, Victoria. "Is Singapore the Worst Environmental Offender?" ASIAONE NEWS. N.p., 14 May 2010. Web. 20 Apr. 2017.
[7] "The World Factbook: SINGAPORE." *Central Intelligence Agency*. Central Intelligence Agency, 12 Jan. 2017. Web. 23 Apr. 2017.
[8] SINGAPORE ENERGY STATISTICS 2015. Energy Market Authority of Singapore.

nations in terms of total imports of refined petroleum products. These petroleum products are primarily in the form of gasoline for automobile use.

Singapore has enacted many policies to reduce the number of automobiles in the country, and to reduce their use in its attempt to become "car lite". Investing in the SMRT has been one step that the country has taken. Currently six out of ten Singaporeans are within a ten minute walk to the SMRT, and the country has plans to increase this number to eight out of ten by 2030[9] . Singapore also utilizes electronic road pricing, certificates of entitlement, and limits the times and dates certain license plates may be on the road. These policies have been successful, and statistics released from Singapore's Land Transit Authority in 2017 indicates that car ownership has decreased for 3 consecutive years[10]. Still, Singapore has struggled with problems with its air quality, primarily as a result of its proximity to Indonesia, and the Southeast Asian Haze.

The Southeast Asian Haze is an annual reduction in air quality that is experienced by Singapore, Malaysia, Brunei Darussalam, Indonesia, the Philippines and Thailand. It results from the slash and burn practices by the foresters of Indonesia. Pollutants contained in the cloud produced by the South Asian Haze have been linked to respiratory illnesses and lung damage[11]. As a result of the Southeast Asian Haze, Singapore's air quality has fallen to dangerous levels. In 2016, air quality in Singapore reached 215 on the Singapore Pollutant Standards Index[12]. Anything above 100 is considered dangerous. In 2015, the PSI was above 300. These conditions

[9] "Fact Sheet - Public Transport Improvements and Future Plans | Ministry of Transport, Singapore." Ministry of Transport. N.p., n.d. Web. 26 Apr. 2017.
[10] Tan, Christopher. "Private Car Numbers Fall to Eight-year Low." The Straits Times. 20 Jan. 2017. Web. 23 Apr. 2017.
[11] "What Causes South East Asia's Haze?" BBC News. BBC, 26 Oct. 2015. Web. 24 Apr. 2017
[12] Id.

have led Singaporeans to avoid going outside, unless it is absolutely necessary, and to wear industrial grade particulate respirators when they do.

To reduce the harmful effects that the Southeast Asian Haze has on its air quality, Singapore has attempted to work directly with Indonesia and has entered into regional compacts with its neighbors that are impacted by the pollution. Since 2005, Singapore has offered aircraft, satellite photos, and fire-fighting assistance to Indonesia[13]. The Prime Minister of Singapore has spoken about developing partnerships with Indonesia beyond monitoring systems, by working directly with the farmers and foresters to develop more sustainable practices[14]. In 2016, the air support Singapore provided to Indonesia included 3 C-130, advanced military transport airplanes. These efforts do not appear to be having the desired ameliorative effects.

The Association of Southeast Asian Nations (ASEAN), of which Singapore is a founding member has also taken steps to combat the Southeast Asian Haze. The ASEAN member countries signed the ASEAN Agreement on Transboundary Haze Pollution on June 10th, 2012 in order to prevent, monitor, and mitigate land and forest fires to control transboundary haze pollution through national efforts, regional, and international cooperation[15]. The agreement had been in development since the Southeast Asian Haze of 1997-1998. Singapore was one of the first to ratify the agreement, in January of 2003. Indonesia, who ratified the agreement in October of 2014 was the last country to do so.

[13] Min, Chew Hui. "Singapore Offers Help to Indonesia to Fight Fires and Haze as Dry Season Starts." The Straits Times. N.p., 07 June 2016. Web. 23 Apr. 2017.
[14] Migration. "Singapore Willing to Work with Indonesia, Malaysia to Tackle Causes of Haze."The Straits Times. 19 Jan. 2016. Web. 23 Apr. 2017.
[15] "ASEAN Agreement on Transboundary Haze Pollution." ASEAN Haze Action Online. ASEAN, 23 June 2016. Web. 22 Apr. 2017.

ASEAN has also developed the ASEAN Peatland Management Initiative (APMI). Under the APMI, the ASEAN Peatland Management Strategy (APMS) covering the period 2006-2020 has been developed to guide the countries to sustainably manage peatlands and reduce fires and associated haze within the framework of the ASEAN Agreement on Transboundary Haze Pollution[16]. Seventy percent of the Peatland, a major contributor to the Southeast Asian Haze, and potentially climate change, is located in Indonesia. The APMS was updated in 2013. To date, the the successes of Singapore's regional agreements and initiatives to curtail Indonesia slash and burn practices, and the resulting haze, have not been studied, but the pollution is continuing and has become an annual phenomenon.

In addition to joining regional agreements, Singapore has been an active supporter of global climate accords. Singapore ratified the Kyoto Protocol, an international treaty to reduce greenhouse gas emissions[17], and the most recent agreement within the United Nations Framework Convention on Climate Change, the Paris Agreement[18]. The Paris Agreement adopted in 2015, required that each nation make a contribution to reach the global goal of reduced greenhouse gas emissions. Each country's contributions are determined individually and are referred to as the nation's Intended Nationally Determined Contribution (INDC). Through its INDC, Singapore outlined its intention to reduce its emissions intensity, the average emission rate of a given pollutant from a given source relative to the intensity, by 36% from 2005 levels by 2030, and to stabilise emissions with the aims of peaking around 2030. Singapore works with

[16] "ASEAN Peatland Management Strategy (APMS)." ASEAN Haze Action Online. 02 Feb. 2016. Web. 26 Apr. 2017.
[17] United Nations Framework Convention on Climate Change. "Status of Ratification of the Kyoto Protocol."
[18] United Nations Framework Convention on Climate Change. "Paris Agreement - Status of Ratification."

the global community to reduce climate despite the fact that Singapore only contributes about 0.11% to global emissions[19].

Singapore has taken steps at the local, regional, and national level to improve the environment and to combat climate change. At the local level, Singapore is resisting the natural desire to become a society dependent on the automobile and has put a heavy cost on driving. Singapore has implemented these policies while investing heavily into public transportation and infrastructure to give their citizens options for mobility. In combatting the Southeast Asian Haze, Singapore has entered into agreements with regional players and has invested resources to get Indonesia, the source of the pollution, to make a change. On the international stage, Singapore has showed leadership by signing onto international agreements. Although Singapore is very small, it is proving itself to be an economic and environmental leader in the region of the world that is home to 60% of the world's population.

B. Hong Kong

Hong Kong is a Special Administrative Region of the country of the People's Republic of China. Situated partially on an island and a peninsula in the South China Sea, Hong Kong is approximately twice the size of Singapore, and is home to 7.2 million residents[20]. Macau, another Special Administrative Region of China, lies 40 miles to its west. Like Singapore, Hong Kong is also very developed. Its GDP per capita is $58,000[21]. Hong Kong's economy is built on its role as a center for international trade and finance, a role it has played since the early days of British Colonization. As a center of global trade, and finance, Hong Kong has one of the busiest airports,

[19] "Singapore's Submission to the United Nations Framework Convention on Climate Change (UNFCCC).
[20] "The World Factbook: HONG KONG." Central Intelligence Agency. Central Intelligence Agency, 12 Jan. 2017. Web. 26 Apr. 2017.
[21] Id.

ports, and stock exchanges. Hong also has a very developed public transit system, the Mass Transit Railway (MTR) that is used to make over 90% of the daily travels[22].

Despite its well functioning metro system, Hong Kong has struggled with vehicular pollution and has high air quality concerns. In 2010, the transport sector, including road and marine transport, was the second largest pollution source in Hong Kong[23]. It accounted for about 57% of the local respirable suspended particulates, 62% of nitrogen oxides and 48% of sulphur dioxide. Hong Kong's air quality is also harmed from the production of energy, 53% of Hong Kong's power is provided through burning coal[24]. Additional air pollution is sourced from the huge number of manufacturing plants located nearby in Mainland China. Everyday, more than 90% of Hong Kong residents breath unsafe air[25]. Compared to international cities, Hong Kong's air is 1.9 times more polluted than Tokyo's, 1.6 times worse than Singapore's and 3 times worse than New York's[26].

In 2013[27], Hong Kong's Environment Bureau released "A Clean Air Plan for Hong Kong". The plan estimates that by 2020, regional air quality will be much improved as a result of tighter regulation in Hong Kong and on the Mainland for both industry and transportation. It realizes the importance of regional cooperation to improve Hong Kong's air quality, and states that "even if Hong Kong emits no air emissions, we cannot meet World Health Organizations Air Quality Guidelines". The report identifies efforts included in China's 11th Five Year Plan

[22] Transport Department - Travel Characteristics Survey 2011 - Final Report. N.p., 27 Aug. 2015. Web. 26 Apr. 2017.
[23] "Pilot Green Transport Fund." Pilot Green Transport Fund | Environmental Protection Department. Web. 26 Apr. 2017.
[24] Report on the Public Consultation on Future Fuel Mix for Electricity Generation in Hong Kong. Environmental Bureau, 2015.
[25] "How Polluted Is Hong Kong | Clean Air Network 健康空氣行動." Clear Air Network 健康空氣行動. 10 Feb. 2017. Web. 26 Apr. 2017.
[26] Id.
[27] A Clean Air Plan for Hong Kong. Hong Kong: Environment Bureau, 2013.

(2006-10), the 12th Five Plan (2011-15), and the 13th Five Year Plan (2016-2020); to reduce SO2, NOx, and to reduce emissions and energy and carbon intensity.

As of 2015, Hong Kong had over 820,000 cars[28]. A recent study by Health and Air Action, specifically identified traffic flow as a serious contributor to Hong Kong's New Territories, a region of Hong Kong located near Mainland China[29]. Hong Kong's traffic concerns and the fact that it has the the highest number of skyscrapers in the world creates a street canyon effect, where air from below does not have a means of escape and essentially continues to cycle in a confined space[30]. This phenomenon causes levels of nitrogen oxide and nitrogen dioxide to exceed air quality objectives set by the city, and makes walking on Hong Kong's streets unpleasant, which contributes to more automobile use. The "Clean Air Plan for Hong Kong" identifies that urban planning solutions will be found to resolve issues associated with the street canyon effect. Over the long term, Hong Kong will adopt planning and design solutions in new districts and areas targeted for regeneration.

To improve the air quality on Hong Kong's streets and to reduce automobile use, Hong Kong is engaging in a multipronged approach. One of the policies that the city has approved is to promote electric vehicles. In doing so, the city is waiving up to $97,500 HKD for vehicle registration fees for private vehicles, and waiving the fee in toto for commercial vehicles[31]. Hong Kong is also providing tax incentives for environmentally-friendly vehicles, defined as cars with low emissions and high fuel efficiency, and phasing out the use of diesel commercial vehicles.

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[28] "What Makes Our Air Unbreathable | Clean Air Network 健康空氣行動." Clear Air Network 健康空氣行動. 10 Feb. 2017. Web. 24 Apr. 2017.
[29] "Report: New Territories West Air Pollution Is More Serious or Due to High Traffic Flow." 立場新聞 Stand News. 12 Jan. 2017. Web. 26 Apr. 2017.
[30] "Scientists Examine the Health Risks of Hong Kong's Notorious 'street Canyons'." South China Morning Post. 12 Oct. 2014. Web. 20 Apr. 2017.
[31] Air | Hong Kong Environmental Protection Department. Web.

Hong Kong has also implemented the $300 Million Pilot Green Transport Fund[32]. The fund supports the testing of green and innovative technologies applicable to the public transport sector and goods vehicles. Currently there 94 trials under the Fund for testing electric taxis, light buses, electric buses, electric goods vehicles, hybrid goods vehicles, hybrid light buses, a bus solar air-conditioning system, an electric inverter air-conditioning systems and the adoption of a diesel-electric propulsion system and a seawater scrubber on a ferry, involving a total subsidy of about $86 million HKD. With all of the measures that Hong Kong has implemented to improve air quality, there has been some progress. Major air pollutants have dropped in 2013 relative to 1999: respirable suspended particulates, sulphur dioxides and NOx decreased by 37%, 59% and 29% respectively[33].

In order to reduce causes of environmental pollution within Hong Kong, but coming from outside of Hong Kong's Jurisdiction, the city has developed the Hong Kong - Guangdong Joint Working Group on Sustainable Development and Environmental Protection[34]. Guangdong is a large province of 108,500,000 people, located to Hong Kong's west. Its GDP is $1.2 trillion USD. The Joint Working Group released a report of all of the major achievements of the environmental collaboration for the year of 2016. These achievements included: signing an agreement to deepen cooperation on environmental protection and improve regional environmental quality; implemented measures to enhance regional quality, including tightening the power sector's emission caps and phasing out certain diesel commercial vehicles; and setting

[32] Pilot Green Transport Fund | Hong Kong Environmental Protection Department. Web.
[33] Cleaning the Air at Street Level | Hong Kong Environmental Protection Department.
[34] "16th Meeting of Hong Kong-Guangdong Joint Working Group on Sustainable Development and Environmental Protection Held in Guangzhou (with Photos)." The Government of the Hong Kong Special Administrative Region. Web. 22 Apr. 2017.

up various proposals, panels and plans to forecast pollution and to move other climate and environmental initiatives forward.

A report by the Wilson Center found that cooperation between the two regions, with respect to the rapid deterioration of the quality of environment in the Pearl River Delta Region was moving slow[35]. They stated that the cause for the lack of progress was the ad hoc nature of the cooperation, and how there has not been much progress beyond the policy consultation stage. The organization also found that Guangdong lacks incentives for managing pollution in a cross border perspective.

As far as international agreements, Hong Kong is not a signatory to either the Kyoto Protocol or the Paris Accords. However, China, as a signatory to the Paris Accords, has declared that the agreement applies to Hong Kong. Additionally, Hong Kong has not had to produce an IDNC. In China's IDNC, Hong Kong was not specifically mentioned[36]. Still, in response to the Paris Agreement, Hong Kong released its Climate Action Plan 2030+ in January 2017.

The Climate Action Plan[37] lays out an ambitious strategy to phase out coal, implement renewable energy, make building and infrastructure more energy efficient, improve public transport and opportunities for walking, strengthen climate readiness as a whole, cool the city through landscaping, and to partner with stakeholders to ensure that the community is more climate resilient. Hong Kong states in its plan the goal to reduce its carbon intensity to 65% to 70% of its 2006 figure by 2030. As local electricity generation is the biggest contributor to carbon emissions, making up about 70%, changing Hong Kong's energy mix is a primary goal.

[35] Lo, Carlos Wing-Hung, and Yok-Shiu F. Lee. "Regional Environmental Protection: The Hong Kong - Guangdong Experience."
[36] "A Closer Look at China's New Climate Plan (INDC)." World Resources Institute. Web. 24 Apr. 2017.
[37] "HONG KONG'S CLIMATE ACTION PLAN 2030+." Environment Bureau. Web.

Relying on natural gas has already allowed Hong Kong to make some of the strides that it has had relative to reducing carbon emissions and improving air quality, but when coal is being decommissioned, its being replaced by natural gas. Although it is cleaner than coal, natural gas is still a carbon based fuel and does not totally ameliorate the problem.

Hong Kong is an a very unique situation. It is a wealthy semi-autonomous region that is located off the coast of the world's largest country by population, one of world's largest polluters. Regardless of the initiatives it engages in internally, it will not be able to improve its air quality without regional assistance. Its regional efforts, a legal reality, have not yet had any practical benefit. Hong Kong is taking steps to reduce its environmental footprint, but its efforts are vastly overshadowed by its legal status as a region of China, and its geographic proximity to Guangdong, the industrial giant to its west.

II. Review of other Global Cities

The Globalization and World Cities Research Network, which ranks global cities based on their connectivity with the rest of the world[38], list Singapore and Hong Kong, along with Paris, Beijing, Tokyo, Shanghai, and Dubai, as Alpha + cities. This is the second highest ranking provided by the organization. London and New York are the only cities rated as Alpha + +. In this next section, I will briefly review the policies that these cities have adopted in response to environmental degradation and climate change. These cities are similar to Singapore and Hong Kong as they all have similar population levels, economies, and all have difficulties related to vehicle congestion and pollution. As cities, all 4 have to be concerned about remediating their own pollution, but have to be willing to work with regional partners. These cities differ as they

[38] "The World According to GaWC 2016." The Globalization and World Cities (GaWC) Research Network. 2016. Web. 26 Apr. 2017

are all in different regions of the world, and operate under different legal systems. Additionally, Singapore is self-governing, and Hong Kong is semi-autonomous  Assessing these cities against one another, will reveal policies that are or are not working and provide insight into what other cities should adopt to solve similar problems.

A. London

London is the capital of the United Kingdom and has a population of 8.6m. In 2010, London was found to be one of most polluted places in Europe, and as it was then a part of the European Union, it faced court cases and unlimited fines[39]. The poor quality of London's air is considered the biggest public health issue in the UK and a report by the House of Common found evidence that air pollution contributed to 50,000 deaths in the UK a year[40]. A study by then Mayor of London, Boris Johnson, calculated that more than 4,300 deaths are caused by poor air quality in the city every year. The cause of London's poor air quality have been linked diesel vehicles. Diesel vehicles emit close to 40% of the cities emissions of both NOx and the particulate PM10, which is linked to elevated risk of adverse pregnancy outcomes, and low birth rates[41]. The current Mayor of London, Sadiq Khan, has enacted tough measures to improve the city's air quality. Mayor Khan will be investing £875 million  between 2016 and 2020 in policies related to air quality[42].

Similar to Singapore, London has a system of congestion pricing in the city's central areas. In addition to the fee used to reduced general congestion, a "Toxicity Charge" will be

[39] Vidal, John. "London Air Pollution 'worst in Europe'." The Guardian. Guardian News and Media, 25 June 2010. Web. 26 Apr. 2017.
[40] Carrington, Damian. "The Truth about London's Air Pollution." The Guardian. Guardian News and Media, 05 Feb. 2016. Web. 26 Apr. 2017.
[41] Vehicle Emissions | Air Pollution | City Diesel | LPG | CNG. Web. 26 Apr. 2017.
[42] "Cleaning up London's Air." London City Hall. 04 Apr. 2017. Web. 26 Apr. 2017.

enacted against the oldest and most polluting vehicles in Central London[43]. In 2020, the Toxicity Charge will be phased out and replaced with an Ultra Low Emission Zone (ULEZ). The ULEZ, will be an area located in Central London where cars, motorcycles, vans, minibuses, buses, coaches and heavy goods vehicles will need to meet exhaust emission standards or pay a daily charge. Wherein the Toxicity Charge applies only to dirty cars, the ULEZ will apply to all cars that are not "clean". The ULEZ is separate from the five "Low Emission Neighbourhoods" that will be set up with strict measures for the most polluting vehicles, car-frees days, green taxi ranks for zero emission-capable cabs and parking reserved for the cleanest vehicles[44]. To help reduce the costs of purchasing a low emission vehicle, the government is providing a grant of up to £4,500 for cars, £8,000 for vans, and £1,500 for motorcycles.

In addition to the £875m allocated to improving air quality, London is, investing £20m in the Air Quality Fund to help local councils focus more on air quality, investing £1 billion in new facilities to make cycling safer and more enjoyable, and creating regional planning policies to cut emissions from development and construction[45]. London has enacted the Mayor's Climate Change Mitigation and Energy Strategy to reduce the cities carbon dioxide emissions by 60 of their 1990 level by 2025. In accomplishing this goal, the city is working to: energy use from buildings, working to supply more energy locally, supporting hydrogen to power transport and heat and power cities, and increasing jobs and investment into the green economy[46].

[43] "The Mayor's New £10 'Toxicity Charge' for London's Most Polluting Cars." London City Hall. 17 Feb. 2017. Web. 26 Apr. 2017.
[44] "Sadiq Khan Boosts Pollution Fund to Tackle London Toxic Air Hotspots." London City Hall. N.p., 20 July 2016. Web. 26 Apr. 2017.
[45] "Cleaning up London's Air." London City Hall. 04 Apr. 2017. Web. 26 Apr. 2017.
[46] "Sadiq Khan Boosts Pollution Fund to Tackle London Toxic Air Hotspots." London City Hall. N.p., 20 July 2016. Web. 26 Apr. 2017.

B. New York

New York City, located at the at the southern tip of New York state, with a population of 8.5 million, is the most populous city of the United States[47]. As a natural harbour, it provides access to the Atlantic Ocean. New York is also the nation's most densely populated city. Aside from the amount of people who live in New York, many people work in New York. The Census found that commuters nearly double Manhattan's daytime population from 1.6 million, to 3.1 million[48]. In addition to being the most populous, and the most dense, New York is routinely listed as one of the dirtiest American cities, and was found to be the dirtiest American city in 2012[49].

In an effort to change its perception, and to improve the quality of life in the city, then Mayor Michael Bloomberg enacted PlaNYC, a comprehensive plan to improve equity in the city, and well as improve the economy and environment. His successor, Bill de Blasio, reformatted the plan into OneNYC. OneNYC consists of 6 goals: (1) to have greenhouse gas emission in 2050 reduced by 80% from the 2005 levels, (2) send zero waste to landfills by 2030, (3) have the best air quality among all large U.S. Cities by 2030, (4) clean up contaminated land and convert them into safe and beneficial uses, (5) mitigate flooding and offer high quality water services, and (6) develop more open spaces[50].

To achieve the first goal of reducing greenhouse gas emissions, the city estimates that it will have to reduce 43 million metric tons of gas emissions: nine million metric tons from power production, seven million metric tons from personal and commercial vehicles, two million metric

[47] "New York City Population." NYC Population Facts. Web. 26 Apr. 2017.
[48] Roberts, Sam. "Commuters Nearly Double Manhattan's Daytime Population, Census Says."The New York Times. 03 June 2013. Web. 24 Apr. 2017.
[49] Hunt, Katrina Brown. "America's Dirtiest Cities." Travel + Leisure. Web. 26 Apr. 2017.
[50] "The Plan for a Strong and Just City." #OneNYC. Web. 26 Apr. 2017.

tons from the disposal of solid waste, and 25 million metric tons from energy used in buildings. Unlike London, which is implementing policies to curb bad behavior, New York is primarily investing in technologies and practices to improve the city's efficiencies. These improvements include installing onsite renewable power in every city-owned building that has significant energy use, implementing leading edge performance standards for new construction, and developing energy performance standards for existing buildings[51].

III. Conclusion

Each of the city's analyzed have their own unique environmental challenges. Hong Kong and Singapore, though they have enacted progressive policies to reform their internal practices, are harmed by external forces. London on the other hand is being poisoned by a defunct and lingering technology, diesel powered automobiles. New York has environmental challenges stemming from the built environment. While all cities have overlapping concerns, such as the problems associated with automobiles, there is not any possibility for a one size fits all solution. However, pricing the negative externality, or the cause of the externality, can provide a way forward. London has taken a strong stance against air pollution, and the other cities all have attempted to enact similar policies.

Singapore along with ASEAN has to consider sanctioning Indonesia if it desires to reduce the harms associated with the Southeast Asian Haze. It has been a decade since talks first began to organize regional efforts to monitor and reduce the Indonesia's slash and burn policies. Efforts by Singapore to provide resources to Indonesia has not reduced the harmful air pollution. Singapore has enacted programs that force vehicles that emit air pollutants to pay to drive, they

[51] "Policies and Programs." NYC Built to Last. Web. 26 Apr. 2017.

should force Indonesia to pay for its air pollution. Hong Kong has to take a similar position to Guangdong, but the success of such an approach is unlikely. Politically, Hong Kong is in a tenuous position relative to Mainland China. It does not have any ability or authority to impose costs on Guangdong.

Singapore and Hong Kong reveal how complex environmental challenges are and how solutions to environmental issues will not be easily found. The issue is fraught with political, environmental, and economic consequences. Furthermore, the cities show how no city can resolve its environmental challenges on its own. Pricing externalities, investing in innovation, and joining regional, if not international pacts, will be key to these cities' futures. Singapore and Hong Kong, as well as London and New York, have challenges. Still, they are pursuing solutions that other global cities, as well as the emerging megacities in Asia and Africa, can study and learn from as we all will benefit from a more efficient use of our natural resources.